

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1-12 (Canceled)

13. (Currently Amended) A method of culturing a photosynthetic microorganism with a multi-layered photobioreactor, comprising:

(a) injecting a photosynthetic microorganism to a first culture region to execute vegetative cell growth and a second culture region to produce a useful metabolite, wherein the first and second culture regions are equipped in the multi-layered photobioreactor of claim 1 or 2 (step 1);

(b) irradiating light to the second culture region to proliferate the photosynthetic microorganism (step 2); and

(c) harvesting the cultured photosynthetic microorganism from the first and second culture regions (step 3),

wherein the multi-layered photobioreactor comprises:

at least one first culture region containing both a microorganism and a culture medium therein to execute vegetative growth of the microorganism;

at least one second culture region closely layered on a side surface of the first culture region and containing both a culture medium and a microorganism therein to produce a useful metabolite; and

a transparent partition placed between the first and second culture regions to separate the first and second culture regions from each other,

and the first and second culture regions are provided in an inside portion and an outside portion of the photobioreactor, respectively, to allow sun light or artificial light irradiated to the photobioreactor for cultivation to sequentially pass through the second culture region and the transparent partition to reach the first culture region; and a plurality of the photobioreactors as unit modules are spatially arranged to produce another photobioreactor.

14. (Currently Amended) A method of culturing a photosynthetic microorganism with a multi-layered photobioreactor, comprising:

(a) transferring a photosynthetic microorganism grown in a first culture region to execute vegetative cell growth by a batch culture to a second culture region to produce a useful metabolite, wherein the first and second culture regions are equipped in the photobioreactor of claim 1 or 2, and injecting newly subcultured cells of the photosynthetic microorganism into the first culture region (step 1);

(b) irradiating light to the second culture region to proliferate the photosynthetic microorganism and accumulate the useful metabolite (step 2); and

(c) harvesting the photosynthetic microorganism from the second culture region and repeating the steps 1 and 2 2 and 3 by transferring all or a portion of the photosynthetic microorganism grown in the first culture region to the second culture region (step 3),

wherein the multi-layered photobioreactor comprises:

at least one first culture region containing both a microorganism and a culture medium therein to execute vegetative growth of the microorganism;

at least one second culture region closely layered on a side surface of the first culture region and containing both a culture medium and a microorganism therein to produce a useful metabolite; and

a transparent partition placed between the first and second culture regions to separate the first and second culture regions from each other,

and the first and second culture regions are provided in an inside portion and an outside portion of the photobioreactor, respectively, to allow sun light or artificial light irradiated to the photobioreactor for cultivation to sequentially pass through the second culture region and the transparent partition to reach the first culture region; and a plurality of the photobioreactors as unit modules are spatially arranged to produce another photobioreactor.

15. (Currently Amended) A method according to claim 13 of culturing a photosynthetic microorganism using the photobioreactor of claim 1 or 2, comprising wherein the method comprises selectively supplying to the first or second culture region of the photobioreactor a nutrient that has been exhausted with time upon cultivation using the photobioreactor.

16. (Currently Amended) The method according to as set forth in claim 13 or 14, wherein, at the step 2, the light is initially supplied at an intensity capable of forming an optimal condition for the vegetative growth of the photosynthetic microorganism until the photosynthetic microorganism reaches a stationary phase, and then is supplied at an intensity capable of forming a stressed condition for production of the useful metabolite.

17. (Currently Amended) The method according to as set forth in claim 14, wherein, at the step 3, the photosynthetic microorganism is transported by a peristaltic pump or air pressure.

18. (Currently Amended) The method according to as set forth in claim 14, wherein, at the step 2 [[4]], the light is controlled to an intensity capable of forming a stressed condition for the production of the useful metabolite.

19. (Currently Amended) The method according to as set forth in claim 13, wherein the photosynthetic microorganism is selected from the group consisting of *Haematococcus* sp., *Dunaliella* sp., *Chlorococcum* sp., *Chlorella* sp., *Acetabularia* sp., *Microcystis* sp., *Nostoc* sp., and *Oscillatoria* sp.

20. (New) The method according to claim 16, wherein the intensity capable of forming an optimal condition for the vegetative growth of the photosynthetic microorganism is 40-200 $\mu\text{mol}/\text{m}^2/\text{s}$, and the intensity capable of forming a stressed condition is 200-2000 $\mu\text{mol}/\text{m}^2/\text{s}$.

21. (New) The method according to claim 13, wherein the multi-layered photobioreactor further comprises a light irradiation unit to supply light energy to the microorganism in the photobioreactor.

22. (New) The method according to claim 21, wherein the second culture region of the multilayered photoreactor to produce a useful metabolite is formed at an outmost surface of the

photobioreactor, and sunlight is thus irradiated to the second culture region at the outmost surface of the photobioreactor.

23. (New) The method according to claim 21, wherein the light irradiation unit is one or more selected from the group consisting of fluorescent lamps, halogen lamps, optical fibers, neon tubes and light-emitting diodes.

24. (New) The method according to claim 21, wherein the light irradiation unit of the photobioreactor comprises a plurality of independent units which are independently operated.

25. (New) The method according to claim 13, wherein the shape of the photobioreactor is selected from the group consisting of a rectangular flat-plate shape, a cylindrical shape, a tubular shape and other three-dimensional shapes.

26. (New) The method according to claim 13, wherein the photobioreactor further comprises gas injection unit to inject gas into the first and second culture regions.

27. (New) The method according to claim 13, wherein the photobioreactor is arranged in a one-dimensional, two-dimensional or three-dimensional consecutive arrangement.

28. (New) The method according to claim 13, wherein the photobioreactor is equipped with a temperature control unit and a sun screen unit.